Stent graft repair of visceral artery aneurysms

Robert A. Larson, MD,[a] **Jeffrey Solomon, MD,**[b] and **Jeffrey P. Carpenter, MD,**[a] *Philadelphia, Pa*

Endovascular techniques with coil embolization have been used in certain visceral aneurysm cases, often resulting in sacrifice of the involved visceral vessel and end-organ thrombosis. We describe two cases in which stent grafts were used to treat these aneurysms, allowing preservation of visceral artery and end-organ flow while completely excluding the aneurysm. Case 1 was a 50-year-old morbidly obese woman with a history of multiple abdominal operations for renal cell carcinoma who was found to have a large splenic artery aneurysm. A 12-mm × 50-mm Wallgraft endoprosthesis (Boston Scientific, Watertown, Mass) was placed across the aneurysm from a femoral approach. The aneurysm was completely excluded, and splenic artery flow was preserved. A subsequent computed tomographic scan showed complete aneurysm exclusion and preserved flow to the spleen. Case 2 was a 73-year-old man with hypertension with back pain who was found with computed tomographic scan to have an 8-cm hepatic artery aneurysm. Arteriography showed a large saccular aneurysm arising from the mid portion of the common hepatic artery. Two 5-mm × 26-mm Jostent stent grafts (Jomed, Alpharetta, Ga) were placed across the aneurysm neck, completely excluding the aneurysm and preserving hepatic artery flow. The patient became pain free, and subsequent duplex ultrasound scan showed a thrombosed aneurysm with normal hepatic artery flow. Stent graft techniques show early promise as a safe and effective treatment of visceral artery aneurysms in selected patients at high risk. Endografts, unlike coil embolization, exclude the aneurysm and preserve end organ perfusion. Determining the durability of this type of therapy will require further study. (J Vasc Surg 2002;36:1260-3.)

Visceral artery aneurysms (VAAs) are rare but potentially life threatening. The incidence rate has been shown to be between 0.01% and 0.2% in routine autopsy series, but more cases are being detected in asymptomatic patients because of the increasing use of computed tomographic (CT) scan, abdominal ultrasound scan, and other imaging methods.[1] Traditional therapy has been surgical resection or ligation[2] or endovascular embolization.[3] We describe two cases of visceral artery aneurysms that were treated with endovascular stent grafts to exclude the aneurysm from the circulation while preserving end-organ perfusion.

CASE REPORTS

Case 1. A 50-year-old asymptomatic postmenopausal woman with a history of bilateral renal cell carcinoma was found to have a 20-mm splenic artery aneurysm (SAA) on a follow-up CT scan (Fig 1). Her medical history was remarkable for a left radical nephrectomy, right partial nephrectomy, ventral hernia repair, uterine artery embolization for fibroids, C-section, hypertension, mitral valve prolapse, and obesity.

On physical examination, the patient was 5 ft 5 in tall and weighed 290 lbs. Her abdomen was nontender with multiple healed scars. The femoral and pedal pulses were normal. The serum creatinine level was 0.9 mg/dL, and the electrolyte and complete blood cell counts were normal.

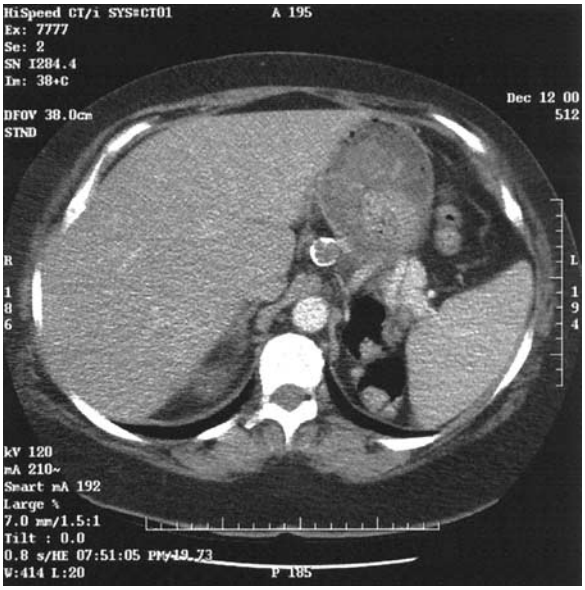

Fig 1. Abdominal CT scan showing calcified SAA.

The patient's comorbidities were believed to make the risk of open surgical repair greater than the risk of rupture of a 20-mm SAA. However, the risk of death from a ruptured SAA would also be great. Therefore, an endovascular approach was chosen, allowing for repair of the aneurysm with an acceptably low procedural risk.

The procedure was performed in the operating room with local anesthesia with sedation. An angiographic c-arm with roadmapping capability was used for radiographic imaging. With femoral access, the celiac artery was selected with a Sos-omni catheter (AngioDynamics, Inc, Queensbury, NY) and the splenic artery was selected with a Glide wire (Boston Scientific, Watertown, Mass). After the patient had been given 5000 units of heparin intrave-

From the Departments of Surgery[a] and Radiology,[b] University of Pennsylvania Medical Center.
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Reprint requests: Jeffrey P. Carpenter, MD, University of Pennsylvania Medical Center, Division of Vascular Surgery, 4 Silverstein, 3400 Spruce St, Philadelphia, PA 19104 (e-mail: Jeffrey.carpenter@uphs.upenn.edu).

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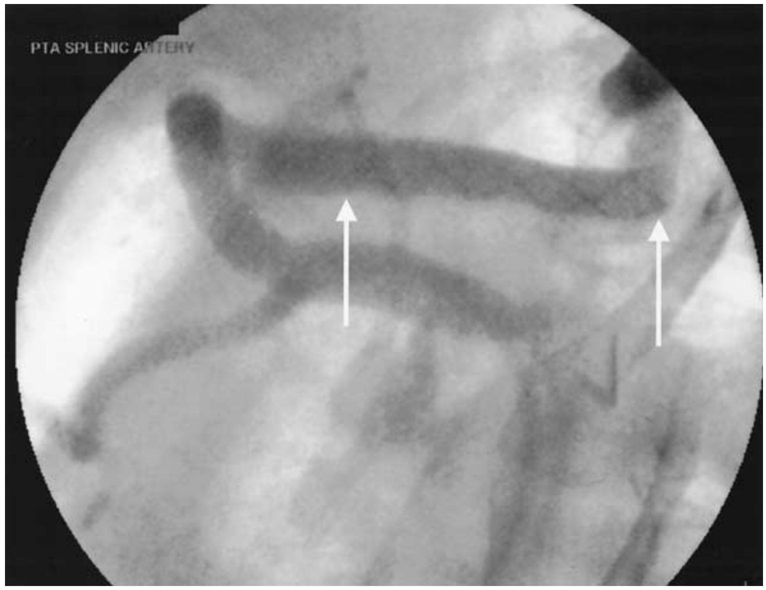

Fig 2. Completion arteriogram showing stent graft placement and preservation of splenic artery flow. *Arrows* point to ends of stent graft.

nously, the glide wire was exchanged via a catheter for Lunderquist wire (Cook, Inc, Bloomington, Ind). Over this wire, a 30 cm–long 12F sheath (Cook, Inc) was advanced to the ostium of the celiac artery. A roadmap arteriogram was performed through the sheath that showed the SAA to be partially thrombosed. Its location was confirmed to be in the mid portion of the splenic artery by the position of the SAA calcification. A 12-mm × 50-mm Wallgraft endoprosthesis (Boston Scientific) then was advanced into position and deployed centered on the SAA. A completion celiac arteriogram showed patency of the hepatic, left gastric, and splenic arteries (Fig 2). The stent graft was in good position in the mid portion of the splenic artery. The heparin was reversed with protamine, and the groin sheath was removed in the recovery room. The patient had a small groin hematoma develop after surgery that was controlled with local compression. She was discharged on the second postoperative day.

A follow-up CT scan was obtained 1 year after surgery and showed continued patency of the splenic artery with successful exclusion of the SAA and no change in the SAA size. The patient continues to do well.

Case 2. A 73-year-old man was evaluated for back pain with CT scan at a local hospital. This scan showed a 5.5-cm × 8.0-cm hepatic artery aneurysm (Fig 3). There was no other intraabdominal pathology noted. The medical history was notable for hypertension, remote myocardial infarction, and mild renal insufficiency with a serum creatinine level of 1.6 mg/dL. The patient had no history of pancreatitis or abdominal trauma.

On physical examination, the patient was a well-appearing man. The blood pressure was 140/90 mm Hg. Abdominal examination revealed a nontender, pulsatile right upper quadrant mass. There were no abdominal bruits. The femoral and distal pulses were normal.

The open surgical and endovascular therapeutic options were discussed with the patient, and the minimally invasive approach

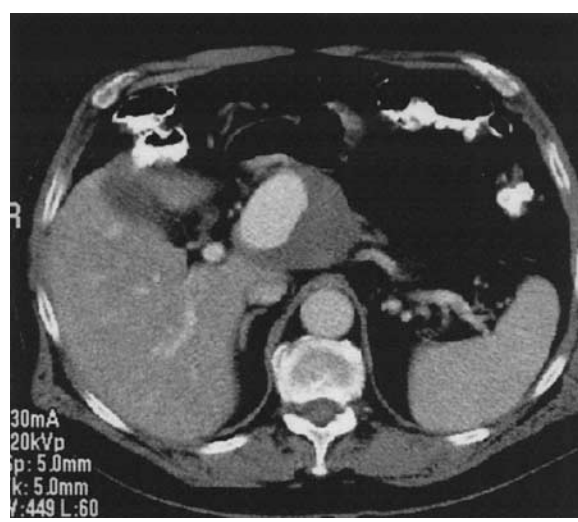

Fig 3. Abdominal CT scan showing large hepatic artery aneurysm.

was chosen. The procedure was performed with local anesthesia and sedation. Right femoral access was used, and the celiac artery was selected with a 5F Simmons 2 catheter (Cook, Inc). A celiac arteriogram showed the saccular aneurysm to be arising from the mid portion of the common hepatic artery (CHA). The aneurysm had a wide neck that was in close proximity to the origin of the gastroduodenal artery. The anatomic configuration made primary coil embolization problematic. Placement of a stent graft was chosen to exclude the aneurysm and maintain patency of the hepatic artery.

The patient underwent full anticoagulation with 4500 units of intravenous heparin. The CHA was selected with a Glidewire

Fig 4. Completion celiac arteriogram showing exclusion of aneurysm by stent grafts and preserved hepatic artery perfusion. Preserved gastroduodenal artery, along with normal splenic and left gastric arteries, are also seen. *Arrows* point to ends of stent graft.

(Boston Scientific). The neck of the aneurysm was traversed with the wire that was then advanced distally into the right/left hepatic artery. The wire then was exchanged over a 5F Cobra GlideCath (Boston Scientific) for an Amplatz wire (Cook, Inc). The sheath was exchanged for a 7F Balkan sheath (Cook, Inc) that was advanced into the CHA. The Amplatz wire was exchanged out for a V18 Control wire (Boston Scientific). A 5-mm × 26-mm Jostent coronary stent graft (Jomed, Alpharetta, Ga) was mounted on a 5-mm × 40-mm Symmetry balloon (Boston Scientific) and deployed in the distal CHA. A postdeployment arteriogram through the Balkan sheath showed continued filling of the aneurysm through the proximal neck of the aneurysm that had remained uncovered. A second 5-mm × 26-mm Jostent was deployed proximal to, but overlapping, the first. A completion arteriogram showed complete exclusion of the aneurysm and preserved perfusion through the CHA, the proper hepatic artery, and the gastroduodenal artery (Fig 4). The splenic and left gastric arteries were normal. The wires and sheathes were removed, and hemostasis was achieved with direct pressure. The patient was discharged in good condition on the first postoperative day.

A follow-up abdominal ultrasound scan was obtained 1 month after the procedure. The hepatic artery aneurysm was found to be thrombosed, and there was normal flow through the CHA. The patient continues to do well.

DISCUSSION

Visceral artery aneurysms are treated with the goal of preventing rupture and exsanguination. The risk of aneurysm rupture is determined primarily by size, although other factors may play a role. Because of the relative rarity and heterogeneity of these aneurysms, their exact natural history is not known. For SAAs, which represent about 60% of visceral artery aneurysms,[4] the life-time rupture risk has been estimated to be between 2% and 10%.[5] This risk is much higher in pregnant women[6] and in patients with portal hypertension.[7] In general, a size of 2 cm or greater is considered significant enough to warrant treatment if the patient's overall condition permits.[8] The presence of a symptomatic aneurysm, an aneurysm in a woman of childbearing age,[6] or an aneurysm with documented enlargement are also indications for treatment. The overall mortality rate of a ruptured SAA ranges from 10% to 25%,[5,8,9] with higher rates seen in pregnant women[6] and patients with portal hypertension.[10] Hepatic artery aneurysms are the second most common visceral aneurysms, comprising about 30% of VAAs, and aneurysms at other sites are extremely uncommon.[11] The traditional therapy of visceral aneurysms has been surgical ligation or excision of the aneurysm, often with attempts to preserve end-organ perfusion depending on the type and location of the aneurysm. Because of the morbidity associated with a major operation, various minimally invasive techniques have been developed. Transcatheter embolization has been used successfully in the treatment of splenic[3] and hepatic artery[12,13] aneurysms, although end-organ ischemia, painful splenic infarction, and late-term vessel recanalization are potential problems.[14,15] Various laparoscopic techniques have also been used with success in treating SAA.[16] The use of stent grafts in the treatment of aortic and peripheral arterial aneurysms is well established. The application of these techniques to visceral artery aneurysms has been recently described in two cases.[17,18] We present two additional patients treated in this fashion with successful exclusion of the aneurysms and preservation of end-organ flow. The arterial anatomy and location of the aneurysm have a large impact on the technical ability to place a stent graft. There needs to be adequate normal-caliber artery on either side of the aneurysm to allow an adequate stent graft seal and complete aneurysm exclusion. Tortuosity in the visceral vessels can also cause difficulty, but the careful use of stiff wires proved to offer sufficient trackability. The risk of vessel rupture or thrombosis is also a concern and could cause significant morbidity depending on the artery affected. These factors will limit the applicability of this technique to those patients with favorable arterial anatomy.

In conclusion, the use of endovascular stent grafts in the treatment of visceral artery aneurysms is a treatment option in well-selected patients, particularly those who would be categorized as high risk. As endovascular technology advances, with the introduction of more flexible stent grafts and smaller introducer systems, it may be possible to offer this therapy to a wider population. The long-term durability of these repairs is not known and will require further study. For the present, these patients should be monitored indefinitely to ensure continued aneurysm exclusion. We plan to use yearly abdominal duplex scan examinations to monitor these patients for continued arterial patency, aneurysm size, and aneurysm exclusion.

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